

Creating the 5000 Year Old Mind:

The MCU Center for Creative and Innovative Complex Problem Solving

Table of Contents

Executive Summary	1
Problem Statement	2
Refining the Concept	2
Proposal: The MCU Center for Creative and Innovative Complex Problem Solving	6
Program Goals and Student Learning Outcomes	6
Assessment	6
The Importance of Faculty	7
A Phased Approach to Implementation	7
Resources and Structure	10
Conclusion	12
Bibliography	13
Contributing Authors	15

Executive Summary

This proposal calls for the establishment of the MCU Center for Creative and Innovative Complex Problem Solving. For over a decade, service posture statements and defense professionals have declared that future military leaders must prepare for an uncertain, complex environment in which wicked problems reign, resources dwindle, and unintended consequences dominate decision matrices. A strong grasp of history, refined analytical capacity, and an appreciation of doctrine are key to succeeding in this environment, but are insufficient on their own.

The Center will focus on developing three concrete skill sets among MCU students: creativity and innovation to enable complex problem solving. Each is critical to the 21st century warfighter as both our adversaries and our operating environment grow more complex. Creativity is defined as the “*production of novelty*.”¹ It encompasses developing an effective and unexpected departure from the familiar. Innovation is the process of using creativity to produce solution to recognized (and not yet recognized) problems. Complex problem solving is defined as solving multi-variant, dynamically interactive problems in situations of ambiguity.²

This QEP has identified three primary program goals: (1) improve students’ creative and innovative complex problem solving skills; (2) prepare civilian and military faculty successfully to create learning environments that enable creativity, innovation, and complex problem solving; and, (3) create mechanisms to integrate student research and learning opportunities across MCU and with larger USMC and DOD planning and development initiatives.

If selected, this QEP will be implemented in three phases: pilot testing and curriculum development; experiential learning across and beyond MCU; and creative and innovative complex problem solving as part of lifelong learning. Faculty development will run throughout all phases. The Center will be staffed by a full-time director (PhD), a full-time deputy (8802 Education Officer), and two part-time Faculty Mentors. The annual operating budget averages \$400,000 annually.

By developing an environment in which creativity and innovation can flourish and by honing students’ capacity for creativity, innovation, and complex problem solving, MCU will enhance student learning, fully meet the mission and vision of the university, and position students to be more competent leaders and decision makers in the challenging times ahead.

¹ Arthur Cropley, *Creativity in Education & Learning: A Guide for Teacher and Educators*, (Sterling, VA: Cogan Page, 2001), 2.

² Joachim Funke, “Complex Problem Solving,” *Encyclopedia of the Sciences of Learning*, (2012), 683.

Problem Statement

For over a decade, service posture statements and defense professionals have declared that future military leaders must prepare for an uncertain, complex environment in which wicked problems reign, resources dwindle, and unintended consequences dominate decision matrices. A strong grasp of history, refined analytical capacity, and an appreciation of doctrine are key to succeeding in this environment, but are insufficient on their own. Without creativity, innovation, and complex problem-solving skills, today's Marines will confront tomorrow's challenges with yesterday's weapons.

Our faculty and students recognize this concern. While students routinely praise the University's focus on military history, Warfighting, and critical thinking, they also call for additional opportunities to explore and create practical contributions to on-going Marine Corps needs. In the words of one anonymous student on the QEP's proposal evaluation survey, "There definitely is a distinction between writing or learning about something that really has no consequence in your day-to-day profession and producing something that takes all aspects of your learning experience and produces something constructive. (think a project concerning T2P2 reduction versus writing about the leadership style of Meade...)."

Former Commandant, Gen Charles Krulak, summarizes the spirit of this proposed QEP:

When I became Commandant, I wanted a place where 'freedom of thought' was not only encouraged, but rewarded. The idea [is] that experimentation should be taken to the failure point....that only by reaching that point would we understand the 'unexpected'.³

An environment conducive to creative, innovative, complex problem solving would be "more than just a test bed of innovation, [but also] a test bed for educational ideas."⁴

Refining the Concept

This proposal focuses on developing three concrete skill sets among MCU students: creativity and innovation to enable complex problem solving. Each is critical to the 21st century warfighter as both our adversaries and our operating environment grow more complex. Each skill set is distinct and so will be discussed in turn. Brought together, they provide a powerful means to achieve the University's mission "to prepare leaders to meet the challenges of the national security environment" as well as to fulfill the University's vision "To further the excellence of our Corps through an educational institution that facilitates the continuing development of leaders, knowledgeable in the art and science of war, *adept at critical and creative thinking, and possessing sound judgment and reasoned decision-making skills.*"

³ Email from Gen. Charles C. Krulak to Dr. Benjamin Jensen, 29 April 2014.

⁴ Email from Gen. Charles C. Krulak to Dr. Benjamin Jensen, 29 April 2014.

Creativity

Creativity is defined as the “*production of novelty*.”⁵ It encompasses developing an effective and unexpected departure from the familiar. While some would challenge whether creativity can be taught,⁶ research suggests that all humans possess creative potential and, with appropriate instruction and opportunity, can develop the capacity to create something effective and unexpected within their field.⁷ Given the uncertainty and complexity of the current operating environment, creativity is more important to military leaders today than ever before.

Helen Haste has identified four skills that underlie creativity: flexibility, critical evaluation, taking multiple perspectives, and exploring nonobvious options.⁸ While none of these skills are foreign to students at MCU, schools can do more to consciously design curricula and educational environments that are proven to develop students’ creative capacity. Currently, MCU curriculum focuses predominantly on critical thinking, not creativity. Students are adept at analyzing problems, but are not provided the same, consistent opportunity of coming up with proposed solutions that are then challenged, defeated, refined, and strengthened.

By focusing on creativity, students risk failure in a low-threat environment. While the stakes may be low, the importance of failure is not. In the words of President George W. Bush, it is in failure that “we will learn and acquire the knowledge that will make successful innovation possible.”⁹ Analysis and evaluation alone are not enough to build students’ capacity to innovate. They must be allowed to create. This QEP focuses on building students’ creative capacity in order to hone students’ ability to innovate. Without creativity, true innovation remains impossible.

⁵ Arthur Cropley, *Creativity in Education & Learning: A Guide for Teacher and Educators*, (Sterling, VA: Cogan Page, 2001), 2.

⁶ Harnad, Stevan. “Creativity: Method or Magic?” *Princeton University Journal*. Available at: harnad@ecs.soton.ac.uk <http://cogsci.ecs.soton.ac.uk/~harnad/> <ftp://cogsci.ecs.soton.ac.uk/pub/harnad/> <gopher://gopher.princeton.edu/11/libraries/pujournals>

⁷ Cropley, *Creativity in Education & Learning*, 10. This argument is supported by research from the MIT Media Lab, a national leader in creativity. See Mitchel Resnick, “All I Really Needed to Know (About Creative Learning) I Learned (By Studying How Children Learn) in Kindergarten,” *Presented at Creativity & Cognition Conference*, June 2007.

⁸ Helen Haste, “Good Thinking: The Creative and Competent Mind,” in Anna Craft, Howard Gardner, and Guy Claxton (eds.), *Creativity, Wisdom, and Trusteeship: Exploring the Role in Education*, (Thousand Oaks, CA: Corwin Press, 2008), 96.

⁹ George W. Bush, “Remarks by the President at the U.S. Naval Academy Commencement,” 25 May 2001, <http://georgewbush-whitehouse.archives.gov/news/releases/2001/05/20010525-1.html> (09 May 2014).

Innovation

Innovation is the process of using creativity to produce solutions for recognized (or not-yet-recognized) problems. Greg Satel has identified four different types of innovation important to today's military professionals.

		Innovation Matrix ¹⁰	
Problem Definition	Well Defined	Breakthrough Innovation (Structure of DNA)	Sustaining Innovation (R&D for iPod)
	Not Well Defined	Basic Research (Quantum Teleportation)	Disruptive Innovation (Netflix)
		Not Well Defined	Well Defined
		Domain Definition	

The advent of amphibious doctrine in the early 1930's may be classified as "disruptive innovation." The domain was well established, though it was Pete Ellis (along with others) who defined the problem set that would be facing the Marine Corps in the years ahead. Creative thinking, applied to a foreseeable problem, led to a redefinition of the Marine Corps and its core missions. Other doctrinal innovations within the Marine Corps (vertical envelopment during the Korean War and Close Air Support during the Banana Wars) may be considered "sustaining innovation." Organizations like the Strategic Initiatives Group and MCWL focus on Basic Research and Breakthrough Innovations.

Today, the limiting of resources and the multiplying of security challenges demands military professionals develop their capacity to innovate. Not every Marine will be Pete Ellis, but every Marine should possess the ability to accurately identify an existing or emerging problem and leverage his or her creative capacity to realize an effective solution. Specifically, developing students' comfort with and ability to engage effectively with "not well defined" problems and domains improves their ability to respond effectively to surprise.¹¹

There are programs within MCU that do better than others at teaching innovation, but all schools have room to improve. Simply studying innovation is insufficient; students must be given the opportunity to practice innovating themselves, and through experimentation, failure and faculty and peer feedback, develop their ability to both "connect the dots" in

¹⁰ Greg Satell, "Before You Innovate, Ask the Right Questions," *Harvard Business Review Blog Network*, 11 February 2013. <http://blogs.hbr.org/2013/02/before-you-innovate-ask-the-ri/>

¹¹ Meeting the requirement found in CJCS's Desired Leader Attribute #2.

new and more useful ways, as well as “see new dots” and how they connect to the larger picture.¹²

Theoretical solutions have their value, but to be truly effective, these solutions must be implementable across a large and diverse defense community. This requires integration of MCU efforts into the broader Marine Corps and DOD community as well as specific development of students’ ability to lead change within and across their particular organizations. This is the purview of Complex Problem Solving.

Complex Problem Solving

Complex problem solving is defined as solving multi-variant, dynamically interactive problems in situations of ambiguity.¹³ Systems are defined as complex based on the number of interacting parts and relationships within them. Complexity increases as the problem solver is left to his or her own devices to identify and define the various parts and relationships. While existing knowledge and experience is crucial to this process, so is the creativity and capacity for innovation discussed above, precisely because these skills refine the problem solvers’ ability to identify overlooked solutions and possible unintended consequences of potential decisions.

While students at MCU have some opportunities to engage in complex problem solving (CPS), introducing creativity and innovation into the curricula should produce an improved ability to solve increasingly complex problems using a process that is implementable, not theoretical. Introducing the possibility for failure (during decision games and war games, for example) and the iterative learning that accompanies experimentation will also enhance complex problem solving skills. In addition, different disciplines have developed widely accepted theories related to complex problem solving.¹⁴ While it may not be appropriate to incorporate study of these theories into all the schools at MCU, the different schools would benefit from looking for ways to integrate CPS theory into their standard curriculum. Finally, building learning opportunities that integrate faculty and students from across MCU can provide both the fresh insight and added friction that strengthens complex problem solving.

¹² David Brier, “What is Innovation?” <http://www.fastcompany.com/3020950/leadership-now/what-is-innovation>

¹³ Joachim Funke, “Complex Problem Solving,” *Encyclopedia of the Sciences of Learning*, (2012), 683.

¹⁴ See, for example, Ohlsson’s Theory of Representational Change in “Information Processing Explanations of Insight and Related Phenomena,” in M.T. Keane & K.J. Gilhooly (Eds.), *Advances in the Psychology of Thinking*, (London: Harvester Wheatsheaf, 1992); John Sweller’s Cognitive Load Theory in “Implications of Cognitive Load Theory for Multimedia Learning,” in R.E. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning*, pp. 19-30. (Cambridge: University Press, 2005); and Gigerenzer & Brighton’s Strategies for Decision Making in “Homo Heuristicus: Why Biased Minds Make Better Inferences, *Topics in Cognitive Science*, 1 (2009), 107–143.

Proposal: Creative and Innovative Complex Problem-Solving: Warfighting Skills for the 21st Century

This QEP proposes to enhance student learning by establishing The MCU Center for Creative and Innovative Complex Problem Solving. While Program Goals and Student Learning Outcomes will be finalized during formal QEP Development over summer 2014, it is possible to identify preliminary goals and existing student learning outcomes related to this proposal.

Program Goal #1: Improve students' creative and innovative complex problem-solving skills.

Program Goal #2: Prepare civilian and military faculty successfully to create learning environments that enable creativity, innovation, and complex problem solving.

Program Goal #3: Create mechanisms to integrate student research and learning opportunities across MCU and with larger Marine Corps and DOD planning and development initiatives.

Existing Student Learning Outcomes Tied to Creativity, Innovation, and Complex Problem Solving

MCWAR SLO: Demonstrate creative reasoning and problem solving at the strategic level, including the robust generation of imaginative proposals to address complex problems, especially those with interagency, multi-national, and cross-cultural dimensions.

CSC SLO: Recognize the complexity and nature of problems. (SLO 4.1)

CSC SLO: Frame problems critically and creatively. (SLO 4.6)

CSC SLO: Apply the Marine Corps Planning Process and other planning approaches to develop collaborative solutions to complex operational problems. (SLO 4.7)

EPME Career Course: The resident course focuses on providing the skills necessary for the Staff Sergeant to act as the "problem solver" and are designed to supply the skills necessary to provide leadership at the platoon level, influence company grade officers, lead and develop subordinate leaders in warfighting, core values, and preserve time-honored traditions.

Assessment

Assessment measures will be driven by the specific outcomes identified during the QEP development phase over summer 2014, so it is premature to specify how MCU will assess this QEP. The development team will construct specific assessments to measure

improvement for both the program goals and specific student learning outcomes as well as identify a specific feedback mechanism to use assessment data to improve QEP implementation.¹⁵ The QEPT will also identify assessment targets for the 5-year interim review.

The QEPT will use Fink's categories of learning to design outcomes and assessments that are both cumulative and interactive, since these elements facilitate the experimentation, tinkering, and iterative approach that promote creativity and innovation.¹⁶

The Importance of Faculty

The first and essential step in enhancing students' ability as creative, innovative problem solvers is preparing faculty to (1) teach creativity, innovation, and complex problem solving, (2) create learning environments that facilitate creativity, innovation, and problem solving, and (3) provide useful feedback to students that empowers the iterative, risk taking process that underlies creativity and innovation.

These three requirements are distinct and essential. Faculty development must build faculty expertise in the substantive literature surrounding these three subject areas; however, subject matter expertise is not enough. A key ingredient of learning creative and innovative complex problem solving is creating an environment conducive to risk taking, tinkering, operating freely within boundaries, and combining disparate bodies of knowledge. Faculty must learn *how* to teach creative and innovative complex problem solving as much as they must learn *what* it is. Finally, the iterative learning process works only to the extent that students receive appropriate and timely feedback on the learning process. Faculty development must focus concretely on how to use assessment opportunities to maximize student learning.

Given the general lack of teaching experience among new military faculty and the rapid turnover in our military faculty, this faculty development component of the QEP will begin in Year 1 and endure for the duration of the QEP. This element of the QEP will develop specific assessments to measure faculty effectiveness, which will be used to update and improve faculty development over the ten years of the QEP.

A Phased Approach

This proposal recommends the following phased approach to reaching the program goals and student learning outcomes:

¹⁵ Kay Gillespie, Douglas Robertson, et. al., *A Guide to Faculty Development*, second edition, (San Francisco: Jossey-Bass, 2010).

¹⁶ L. Dee Fink, *Creating Significant Learning Experiences: An Integrated Approach to Designing College Courses* (San Francisco: Jossey-Bass, 2003).

Proposed Implementation Timeline										
Action	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Program Goal 1										
Pilot Test Options										
Finalize Assessment Protocols										
Curriculum Development Grants										
Curriculum Integration and Review										
Integrated Learning Opportunities across MCU										
Student Research Grants										
Lifelong Learning										
Program Goal 2										
Develop Faculty Subject Matter Expertise										
Create Effective Learning Environments										
Provide Useful Feedback										
Program Goal 3										
Develop Partnerships with External Orgs to Support Research										
Host Annual Innovation Summits										

	On-going through all phases
	Initiated in Phase 1
	Initiated in Phase 2
	Initiated in Phase 3

Phase One

As the faculty prepares to teach creativity, innovation, and complex problem solving, Phase 1 will commence with each of the schools conducting pilot tests of the different elements of the action plan.¹⁷ While specific actions will vary by school, schools will be encouraged to utilize approaches known to foster creativity and innovation (Oxford Style Tutorials, Case Methods, Problem-Based Learning, Experiential Learning, and Experimentation).¹⁸ Just as students' efforts to create and innovate will include experimentation (and potential failure) the schools will be encouraged to experiment with new ways of delivering their curriculum to foster creativity, innovation, and complex problem solving. A core responsibility of the Center will be assisting the schools in this effort. Additionally, the Center will coordinate with History Division and the National Museum of the Marine Corps to find ways to leverage their collections in this process. This proposal also recommends including curriculum development grants to support faculty and school efforts to create learning opportunities that include experimentation and experiential learning. These grants could be awarded for efforts to leverage IET to foster experimentation, create interactive games or cases for classroom instruction, or identify alternative assessment mechanisms to foster risk-taking and experimentation.

Phase Two

Phase Two builds on the school-centered work of Phase One to marshal the power of experiential learning across and beyond MCU. The initiation of integrated learning opportunities across MCU (for example, an MCU-wide colloquium on a topic of importance to the Marine Corps or an MCU-wide exercise) allows students to learn from the experiences and perspectives of those senior and junior to them. This amplifies the potential for creativity and innovation by fostering flexibility, taking multiple perspectives, and exploring nonobvious options. The proposal also recommends the creation of an annual MCU Innovation Summit where students and faculty from across MCU can share research with each other and the larger USMC and defense communities. These summits can either be "open" to include projects of student and faculty choosing, or they can focus on particular problems or domains identified by the CG. This proposal recommends including focused research grants to support faculty and student research in preparation for the Summit.

It is during Phase Two that MCU will be required to conduct its Interim Review with SACS, so time will also be dedicated to assessing QEP implementation to date as a means of improving implementation going forward.

¹⁷ To be developed in Summer 2014.

¹⁸ For a review of how these specific approaches foster creativity and innovation, please see Shelton Goode, *So You Think You Can Teach*, (Bloomington, IN: iUniverse, 2011); Linda Nilson, *Teaching at its Best: A Research-Based Resource for College Instructors*, (San Francisco: Jossey-Bass, 2010); Peter Sutherland (ed.), *Adult Learning: A Reader*, (London: Kogan Page, 1998).

Phase 3

Phase Three will focus specifically on encouraging creative and innovative complex problem solving as an element of lifelong learning. Students go years between their formal PME opportunities, so this element of QEP implementation will focus on building “bridges” between school house and CDET opportunities as a means to better prepare students for their next PME opportunity. Empowering students to maintain and develop their habit of professional development between PME opportunities will improve their performance in school. The Center will work closely with IET as a mechanism to leverage virtual learning environments for this purpose.

Resources and Structure

The Center will fall under VPAA for organizational purposes and consist of a full-time Director (PhD or EdD), a full-time Deputy (8802 Education Officer), and two part-time Faculty Mentors. Given the mandate to incorporate all MCU schools into the QEP and the need for robust faculty development to implement the QEP effectively, the workload to implement the QEP will be substantial, even with the phased approach. Therefore, these positions are essential for the effective functioning of the Center.

Job descriptions will be written following approval of the QEP proposal, but in brief, the Director will be responsible for overseeing implementation of the QEP and SACS reporting requirements. S/he will liaise with the schools to facilitate curriculum review and development, and will carry primary responsibility for facilitating integrated learning opportunities across MCU beginning in 2018. S/he will oversee faculty development efforts and provide reach back to the schools to improve faculty’s teaching skills, create educational opportunities to promote creative and innovative complex problem solving, and improve faculty feedback. Tasks will include support to the schools in developing curriculum to enhance creative and innovative complex problem solving skills, coaching and mentoring faculty on instructional techniques and student feedback, observing faculty in different educational environments, coordinating with schools for schoolhouse faculty development, and administering the faculty curriculum and student research grants programs.

The Deputy will be responsible for day-to-day management of the Center and will be the primary liaison for military faculty development. S/he will support the Director for SACS reporting requirements. S/he will liaise with the schools to facilitate curriculum review and development, and will carry primary responsibility for the Innovation Summit when it begins in 2018. S/he will oversee faculty development efforts and provide reach back to the schools to improve faculty’s teaching skills, create educational opportunities to promote creative and innovative complex problem solving, and improve faculty feedback. Tasks will include support to the schools in developing curriculum to enhance creative and innovative complex problem solving skills, coaching and mentoring faculty on instructional techniques and student feedback, observing faculty in different educational environments, and coordinating with schools for schoolhouse faculty development.

This proposal requests an 8802 specifically to fill this position for a number of reasons. First, these Marines hold the education necessary to meet the requirements of the position. To be designated an 8802 a Marine must complete a Master of Education, which includes course work in adult learning theory, curriculum and instruction, administration and supervision, and teacher leadership (along with particular specialization). While it would certainly be possible to have a Marine without this background succeed at teaching other Marines how to teach, given the importance of faculty quality to MCU's success and the importance of faculty development to faculty quality, it simply makes sense to staff the position with the occupational specialty specifically designated for this task. Second, two-thirds of our faculty is military. While it is not a requirement for Marines to teach other Marines how to teach, placing a fellow Marine in this position certainly improves the possibility to build the relationships necessary for true coaching and mentoring to succeed.

This proposal calls for a minimum of two Faculty Mentors. Faculty Mentors are current MCU faculty with a proven history of teaching excellence and fostering creativity and innovation. In exchange for a release from other collateral assignments these fellows will serve as coaches and mentors to MCU faculty for how to teach creativity and innovation in support of complex problem solving, how to provide student feedback to maximize student learning, and how to create educational opportunities that facilitate learning. At a minimum, this proposal recommends 1 PhD and 1 officer to serve as Faculty Mentors, though the QEPT would certainly encourage identifying Enlisted and CDET Faculty Mentors to maximize the position's utility across all schools.

Finally, MCU is fortunate to have a number of University Chairs who could also provide substantive support to the Center. LtGen Van Riper, Dr. Williamson Murray, and Dr. Bruce Gudmundsson could all have an important contribution to MCU's efforts to foster creative and innovative complex problem solving. With the CG's and VPAA's approval, the Center Director will coordinate how best to leverage the talent and expertise of the MCU Chairs.

Proposed Budget¹⁹										
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Personnel										
PhD	205,000	208,485	212,029	215,633	219,299	223,027	226,818	230,674	234,596	238,584
8802	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind
Faculty Fellows	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind	in-kind
Programs										
Faculty Dev	30,000	30,510	31,029	31,556	32,093	32,638	33,193	33,757	34,331	34,915
Research Grants				20,000	20,340	20,686	21,037	21,395	21,759	22,129
Integrated Learning & Summit				50,000	50,850	51,714	52,594	53,488	54,397	55,322
Curriculum Dev. Grants	20,000	20,340	20,686	21,037	21,395	21,759	22,129	22,505	22,887	23,277
Curriculum	7,500	20,000	20,340	20,686	21,037	21,395	21,759	22,129	22,505	22,887
TOTAL	262,500	299,335	304,424	359,599	365,711	371,928	378,251	384,681	391,221	397,872

Conclusion

By developing an environment in which creativity and innovation can flourish and by honing students' capacity for creativity, innovation, and complex problem solving, MCU will enhance student learning, fully meet the mission and vision of the university, and position students to be more competent leaders and decision makers in the challenging times ahead.

¹⁹ Faculty Development and curriculum costs are basic estimates that will be concretized during the summer QEP development phase.

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